The little Cepheid that stopped

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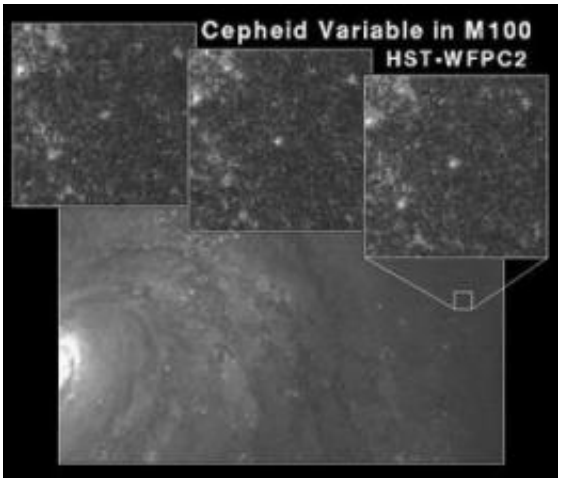

Cepheid Variable Star. Credit: Hubble Space Telescope

When Hubble first discovered a Cepheid variable in the galaxy M31, the universe grew. Previously, many astronomers had held that the fuzzy "spiral nebulae" were small patches of gas and dust within our own galaxy, but through the Period-Luminosity relationship which allowed him to determine the distance, Hubble demonstrated that these were "island universes", or galaxies in their own right.

Soon after, Hubble (as well as other astronomers) began searching other fuzzy patches for Cepheids. Among them was the spiral galaxy M33 in which he discovered 35 Cepheids. Among them was V19 which had a 54.7 day period, an average magnitude of 19.59 ± 0.23 MB, and an amplitude of 1.1 magnitudes. But according to recent work revealed at

the recent American Astronomical Society meeting, V19 no longer seems to be pulsating as a Cepheid.

The new research uses observations from the 3.5m Wisconsin, Indiana, Yale, and NOAO (WIYN) Observatory as well as the 1.3m Robotically Controlled Telescope (RCT) operated jointly by a group of universities and research institutions. The new observations confirm a 2001 report that found V19 had decreased its brightness amplitude to at least less than 10% of the magnitude reported by Hubble in 1926, and possibly further as any fluctuations were below the threshold detectable by the instruments.

Now, if any variation exists, it is less than 0.1 magnitudes. The new study reports that there may be some small fluctuations, but due to inherent uncertainty in the observations, it barely exceeds the background noise and the announcers did not commit to these findings. Instead, they pledged to continue observations with larger instruments to the equation to push down the instrumental error as well as adding spectroscopic measurements to investigate other changes in the star. Another of the peculiar changes V19 has undergone is an increase of about half of a magnitude to 19.08 ± 0.05.

These changes are strikingly similar to another, more famous star: Polaris. Due to its much closer nature, observations have been much more frequent and with lower detection thresholds. This star had previously been reported to have an amplitude of 0.1 magnitudes which, according to a 2004 study, had decreased to 0.03 magnitudes. Additionally, based on ancient records, astronomers have estimated that Polaris has also brightened about a full magnitude in the past 2,000 years.

According to Edward Guinan of Villanova University and one of the members of the new observational team, “both stars are experiencing

unexpectedly fast and large changes in their pulsation properties and brightness that are not yet explained by theory."

The primary explanation for this dramatic change is simple evolution: As the stars have aged, they have moved out of the instability strip, a region on the HR diagram in which stars are prone to pulsations. But these stars may not be entirely lost from the family of periodic variables. In 2008, a study led by Hans Bruntt of the University of Sidney suggested that Polaris' amplitude may be increasing. The team found that from 2003 to 2006, the scale of the oscillations had increased by 30%.

This has led other astronomers to suspect that there may be an additional effect in play in Cepheids known as the Blazhko Effect. This effect, often seen in RR Lyrae stars (another type of periodic variables), is a periodic variation of the variation. While no firm explanation exists for this effect, astronomers have suggested that it may be due to multiple pulsational modes that interfere constructively and destructively and occasionally forming resonances.

Ultimately, these strange changes in brightness are unexplained and will require astronomers to have to carefully monitor these stars, as well as other Cepheids to search for causes.

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